

MONTHLY WEATHER REVIEW,

MAY, 1878.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In compiling the present REVIEW the following data, received up to June 14th, have been made use of, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at one hundred and forty Signal Service stations and fourteen Canadian stations; monthly journals and means from one hundred and thirty-six of the former, and monthly means from thirteen of the latter; reports from twenty-five Special Sunset stations; two hundred and twenty-two reports from Voluntary Observers; thirty-one monthly reports from United States Army Post Surgeons; Marine Records; International Simultaneous Reports; monthly reports of the Weather Services of the States of Iowa and Missouri; reliable newspaper extracts and special reports. The most interesting features of the month have been: the return to normal temperatures east of the Rocky Mountains; the number and severity of tornadoes and thunder and hail-storms; and the heavy rain-falls along the eastern slope from Dakota to northern Texas and Arkansas.

BAROMETRIC PRESSURE.

In General.—On chart No. II is shown the general distribution of atmospheric pressure by the isobaric lines. Compared with the means of previous years, the pressure for the present month is slightly below normal, the deficiency being greatest over New England, where it averages about 0.05 of an inch.

Barometric Ranges.—These have been somewhat smaller than usual, and vary as follows: In New England, the greatest range was 0.86 in. at Eastport, and smallest, 0.75 at Springfield; Mt. Washington, 0.76. Middle States, 0.74 at Albany and New York, and 0.51 at Lynchburg. South Atlantic States, 0.67 at Cape Hatteras, and 0.38 at Tybee Island. Eastern Gulf States, 0.39 at St. Marks and 0.25 at Key West. Western Gulf States, 0.65 at Corsicana and 0.37 at New Orleans. Ohio valley and Tennessee, 0.67 at Pittsburg and 0.42 at Knoxville. Lake region, 0.87 at Alpena, 0.63 at Oswego. Upper Mississippi valley, 0.79 at St. Paul, 0.61 at St. Louis. Missouri valley, 1.06 at Yankton, 0.80 at Bismarck. Plains of Kansas and Nebraska (where the largest ranges occurred), 1.19 at Dodge City, and 1.05 at North Platte. Rocky Mountains and Western Plateau, 0.83 at Salt Lake City, and 0.57 at Santa Fé; Pike's Peak, 0.55. Pacific coast, 0.46 at San Francisco, and 0.28 at Los Angeles.

Areas of High Pressure in General.—Of these six have been sufficiently well marked to warrant description. No. II was attended by severe frosts from the 11th to the 14th.

No. I—appeared during the 1st on the coast of Oregon and Washington Territory; 11 p. m. barometer at Portland, Or., 30.35, or 0.28 above the normal, with cool northerly winds prevailing thence to Nevada and Utah; light snow and a SW. gale on the summit of Pikes Peak, with a temperature of 10°. 2d, a. m. barometer at Portland, 30.44, or 0.32 above normal; 11 p. m. barometer at Salt Lake City, 30.18, or 0.32 above normal; cool and clear weather prevailed throughout this region during the day, the minimum temperature at Boise City being 29°; at Winnemucca 31°, and Cheyenne 30°. A heavy NW. snow-storm also prevailed, during latter part of day, from Dakota to Manitoba, severe squalls being reported in the valley of the Red River of the North. 3d, a. m. barometer at Salt Lake City, 30.24, or 0.36 above normal, where the maximum pressure remained throughout the day; a. m. minimum temperatures, Virginia City and Cheyenne, 28°; Bismarck, 27°, and Pembina and Ft. Garry 26°; the NW. snow-storm in the Northwest con-

tinued during the early part of the day, and high north and northwest winds and gales during latter part of day at Pike's Peak, in western portions of Nebraska and Kansas, and on the coast of Texas. 4th, the pressure fell from Oregon to Colorado, and continued highest in the Southwest, the lowest a. m. temperature, 30°, (except in Dakota and Manitoba) occurring at Santa Fe and Ft. Craig, N. M. During the day the winds in the Southwest changed from northerly to southwesterly, a severe SW. gale and high sea being reported off the mouth of the Brazos river. 5th, the highest pressure was over the Gulf of Mexico, with brisk to high northerly winds in the East Gulf. Cautionary Off-shore signals were ordered on the morning of the 3d at Indianola and Galveston, and were justified by N. winds of 34 and 39 miles respectively.

No. II—formed in the Rocky Mountain region during 7th, in rear of storm-area No. V, and extended eastward. 8th, a. m., barometers above normal at Santa Fe, 0.28 inch; at Dodge City, 0.29, and at Cheyenne and North Platte, 0.26; minimum temperature, 30° at Cheyenne; northerly winds extended over the Southwest, with occasional heavy rains; Cautionary Off-shore Signals were ordered at Indianola and Galveston, the former of which was justified by a wind of 34 miles. 9th, the maximum pressures continued over the western plains and Missouri valley; 11 p. m., barometers at Dodge City, North Platte and Yankton, 0.42, 0.41 and 0.38 above normals, respectively. 10th, minimum a. m. temperatures were reported—at Deadwood and Breckenridge, 30°; Cheyenne, 31°; Pembina, Marquette and Rockliffe, 32°; 11 p. m., barometers at Fort Gibson, Yankton and Pembina, 0.30, 0.32 and 0.35 above normals, respectively; generally clear or fair weather prevailed west of the Mississippi, excepting light rains in southern Texas and New Mexico, but during the 11th and 12th cloud and rain increased from Texas to Dakota, the storm-center, No. VIII, probably developing in this region. 12th, a. m., barometers at Yankton, Breckenridge and Pembina, 0.35, 0.36 and 0.36 in. above normals, respectively; minimum temperatures, Pembina and Fort Garry, 24°; Yankton and Escanaba, 28°. 13th, a. m. barometers at Yankton, Breckenridge and Pembina, 0.23, 0.27 and 0.28, above normals, respectively; minimum temperatures, Pembina, 28°, Port Stanley, 29°, Breckenridge, Escanaba, Alpena and Rockliffe, 30°. 14th, a. m. barometer at Escanaba, 30.14, or 0.16 above normal; minimum temperatures, Saugeen, 27°, Escanaba, 28°, Alpena, 30°, Marquette, Parry Sound and Rochester, 31°. 15th, a. m. barometer at Father Point, 30.14, or 0.24 above normal, and at Chatham, 30.16, or 0.23 above normal; minimum temperatures, Rockliffe, 27°, Saugeen, Parry Sound and Chatham, 28°. From the 11th to the 14th quite severe and destructive frosts occurred in Iowa, the Lake States, Maryland, New Jersey and New England; ice formed very generally and snow was reported in Dakota, Iowa, Ontario, New York, Pennsylvania and northern portions of New Hampshire and Vermont.

No. III—appeared over Lake Superior during the night of the 16th., and on the 17th. extended eastward over the Lake region. 18th, a. m. barometer at Saugeen 0.26 in. above normal; 11 p. m. barometer at Father Point 0.34 above normal. On the morning of the 19th it appeared central over the Gulf of St. Lawrence, and the isobar 30.10 included the whole Atlantic States. During the 20th, the pressure gradually gave way in advance of storm-area No. IX, and during the 21st, this area disappeared to the eastward.

No. IV—appeared during the 20th, in the Northwest, in rear of storm-area No. IX, the isobar 30.10 extending southeastward to Lower Michigan, Indiana and western Tennessee by the morning of the 21st; southwestward of this area easterly winds and increasing cloudiness prevailed in advance of storm-area No. XII. Morning of the 22nd, isobar 30.20 included the Lake region, the pressure being 0.31 above normal at Escanaba, Saugeen and Parry Sound; minimum temperatures, Parry Sound, 32° and Rockliffe, 31°. During the day the centre remained almost stationary, but with a decrease of pressure, and, during the 23rd, this area was either dissipated or moved off to the northeastward.

No. V—The pressure rose during the 22nd in Oregon, Washington Ty., and Idaho, with clearing, followed by clear weather; remained high during the 23rd, and reached the maximum at Portland, Or. on the morning of the 24th; a. m. barometer 30.34 or 0.22 above the normal. During the rest of the day, however, the pressure fell in this district, but rose at the Rocky Mountain stations. 25th, a. m. barometer at Cheyenne and Denver, 0.24 and 0.27 above normals; the pressure remained high in this region throughout the 25th, but on the 26th this area was probably dissipated in advance of low pressure area No. XIII.

No. VI.—This area appeared over Manitoba on the 27th; spread over the Lake region during the 28th, and over lower Canada and northern portion of New England during the 30th and 31st.

Areas of Low Pressure in General.—Of these, thirteen have been well-marked and their tracks are shown on chart No. I. The most severe were Nos. I, V, VIII, IX and XII, the last being accompanied by the severe tornadoes of the 23rd in Wisconsin and Illinois. Nos. II, IV, VI, VII and X were subsidiary areas.

No. I.—This area of low-pressure probably developed in the Southwest during the 1st, when brisk to high southerly winds were reported in northern Texas and Indian Territory, and (at 11 p. m.) high northwest to northeast winds in Colorado and western Kansas; during the night of the 1st, it moved northeastward, and heavy rains were reported at Leavenworth, Des Moines and Dubuque. During the 2nd, it passed eastward over the Lake region, accompanied by brisk and high winds and light rains. Cautionary Signals were ordered up on the morning of the 2nd, on Lakes Michigan, Huron and Erie and maximum velocities were reported, as follows: Chicago, SW., 25 miles; Port Huron, S., 36; Saudusky, SW., 32, and Cleveland, S., 48. 3rd. the lowest pressure apparently remained north of Lake Ontario and New York, with continued rain, cloudy weather and thunder-storms in the Lower Lake region, and thence southwestward to the Gulf

coast. 4th, the lowest pressure probably continued in northeastern New York, the barometric trough extending southwestward along the Appalachian chain to Virginia; a severe thunder-storm occurred in Florida from 5:40 to 9:30 p. m., maximum velocity at Punta Rassa, NW. 36. At 7:35 a. m. of the 5th, the lowest pressure was recorded at Cape May, 29.57 or 0.46 in. below the normal; wind S., 31 miles. Northerly winds prevailed from Philadelphia to Washington, and westerly from Lynchburg to Wilmington; a severe thunder-storm, with hail, passed over Wilmington at 3 a. m.; wind NW., 52 miles; steamer "Northeast" blown ashore in Cape Fear river. At 4:35 p. m., the centre had apparently withdrawn to the northward; Quebec, 29.48 or 0.41 in. below normal, wind N., gale; heavy rain-falls were recorded on the North Carolina and New Jersey coasts, in the Hudson river valley and over Lake Champlain, and a severe gale prevailed on the New England coast. At 11 p. m., the centre had passed to the northeast; Father Point barometer 29.40 or 0.46 in. below normal, wind S., 19. Cautionary Signals were ordered, at midnight of the 2d, from Sandy Hook to Cape May, and, on the morning of the 3rd, from Cape Lookout to Wood's Holl. At 4 p. m. and midnight of the 3rd, all signals were ordered down, but were again hoisted, on the morning of the 4th, at Cape May and on the coast of North Carolina. Morning of the 5th, signals were ordered up on the coast of New England from New York to Wood's Holl. The following maximum velocities were recorded: 3rd, Cape May, S., 36, and Kittyhawk, SW., 32. 4th, Kittyhawk, W., 48, and Cape May, S., 36; 5th, Cape Lookout, SW., 50; Cape Hatteras, SW., and Kittyhawk W., 48, and Wood's Holl, S., 45.

No. II.—During the 1st, a low pressure area existed in Manitoba. 2nd, a. m., barometer at Pembina, 29.56 or 0.39 in. below normal; during the day and night it was followed by high NW winds and snow, the area probably joining area No. I.

No. III.—was probably a depression passing northward off Nova Scotia and Cape Breton.

No. IV.—During the early morning of the 4th, the pressure fell at Duluth, with light rain, and a small area of low barometer, probably formed over western portion of Lake Superior, which moved eastward, during the day over Northern Michigan. Morning of the 5th, it was north of Lake Huron, and probably joined area No. 1.

No. V.—As high-pressure area No. I moved towards the Southwest the pressure fell rapidly, and, during the 5th, an extensive area of low pressure appeared in the Northwest. At 4:35 and 11 p. m., the minimum pressure was recorded at Pembina, (29.44 or 0.38 and 29.42 or 0.44 below normals, respectively,) but at both these times of observation the low-pressure area appeared to extend southwestward to Salt Lake City, (29.55 or 0.31 in. and 29.61 or 0.25, respectively.) Brisk southwest to northwest winds, with partly cloudy weather, prevailed in Nevada and Utah, and, with rain, in Idaho; rain and sleet also prevailed in Montana and Dakota. 6th, the low area moved southeastward, and, at 11 p. m., was central from Kansas to Iowa, followed by high northerly winds in Nebraska, and heavy rains in Wyoming and Colorado, and preceded in the Upper Mississippi valley and Lake region by southerly winds, increasing cloudiness and light rains. On the night of the 6th a subsidiary centre formed in the Lake region, and, at 7:35 a. m., of the 7th, was central in Lower Michigan; it will be treated as area No. VI. During the 7th the present area moved eastward to Illinois, preceded by a thunder-storm on Lake Michigan. During the night it passed eastward to northern Indiana, with severe wind and rain-storms in its SW. quadrant; at 3 a. m., 8th, a severe wind and rain-storm passed over Memphis, and heavy rains fell in the valley of the Arkansas river. During the 8th it passed over the Lower Lake region, accompanied by light rains, and, on the 9th, disappeared to the northeastward. Cautionary Signals were ordered up, morning of the 9th, along the New Jersey and New England coasts, but were only justified at Eastport, Me., maximum wind E. 30 miles.

No. VI.—This area probably formed during the night of the 6th, in Wisconsin, subsidiary to area No. V. 7th, was central in the Lower Lake region, accompanied by numerous thunder-storms thence to the Ohio valley, and, by morning of the 8th, had disappeared. Cautionary signals were ordered, a. m. of the 7th, on Lakes Huron, Erie and Ontario. Maximum wind velocity, Cleveland, S.W., 36 miles.

No. VII.—was also subsidiary to storm-area No. V, and appeared as a separate depression, on the morning of the 9th, over the Middle Atlantic coast. During the latter part of the 8th, heavy thunder-storms were reported in Virginia; at Richmond a violent storm of wind, rain and hail was reported. 9th, 4:35 P. M., the centre had passed off the coast and was followed by brisk northeast to northwest winds and clearing weather. 10th, moved northeastward to Nova Scotia, accompanied by coast rains. 11th, remained over the Canadian Maritime Provinces, and, on the 12th, moved eastward, followed by westerly winds and clearing weather.

No. VIII.—probably developed during the 11th over the high lands of northwestern Texas and western Kansas; at 11 p. m., high northeast winds prevailed in latter section, and southeast winds and cloudy weather thence to the Lower Mississippi valley and East Gulf coast; northeast winds and rain in Kansas and Missouri. 12th, remained in the Southwest, but on the 13th moved eastward to Alabama, accompanied by cloudy weather and light rains from the Gulf coast to the Ohio valley. At 7:35 a. m., 14th, it was central in Georgia, with south to east winds, threatening and cloudy weather, and light rains thence to the South Atlantic coast and Virginia. The Cautionary Signals, ordered up on the morning of the 12th, in advance of a small depression, which had probably developed during the early morning in the interior of the South Atlantic States, were continued, and signals were also ordered up, on the morning of the 14th, at Wilmington and Smithville. At 4:35 p. m. it was central in South Carolina, and brisk to high southeast

winds prevailed along the coast from Cape Lookout to Cape Henry; 11 p. m., central on coast of North Carolina, SE to NE gales and heavy rains prevailing from Hatteras to Henry; steamer "Resolute", 60 miles off Hatteras in Gulf Stream, reports "regular cyclone", and steamer "Columbus", 60 miles north of Hatteras, "severe easterly gales from SE to NE and N, with terrific squalls and bad cross-seas." - 15th, 7:35 a. m., centre had passed off the coast, and E to NW high winds and gales prevailed on the New Jersey and North Carolina coasts; unusually high tides occurred, and Chesapeake Bay was considered too rough for Baltimore steamers to leave; ship "Eastern Star", lat. $37^{\circ} 30' N.$, long. $74^{\circ} W.$, reports "heavy gale backing to NE, and blowing hurricane for 18 hours." During the rest of the day the winds along the coast decreased, with clearing weather, and the storm-centre moved northeastward, with light rains along the New England and Nova Scotian coasts. Cautionary Signals were ordered up, afternoon of the 14th, from Cape May to Sandy Hook, and morning of the 15th, from New York to Eastport. Maximum velocities—Smithville, SE., 31 miles; Capes Lookout and Henry, NE., 48; Cape Hatteras, SE., and Kittyhawk, N., 56; Atlantic City, NE., 44; Barnegat, E., 45; Sandy Hook, NE., 36, and Thatcher's Island, NE. 32. In rear of this storm the temperature fell quiet low, and severe frosts were reported on the morning of the 16th in Pennsylvania and Virginia.

No. IX.—During the 15th high temperatures were recorded in northwestern Texas and New Mexico; south to east winds, occasionally high, from the West Gulf coast to Iowa, and northerly winds from New Mexico to Wyoming; heavy rains and thunder-storms occurred in southern Texas, Indian Territory and Nebraska. At 4.35 p. m. the lowest barometers were at Dodge City (29.14, or 0.18 in. below normal), and Ft. Sill (29.42, or 0.24). On the 16th heavy snows and rains were reported in Utah and Colorado, and at 11 p. m. the lowest barometers were at Cheyenne (29.64, or 0.26 below normal), and Denver, (29.57, or 0.36), the latter being the lowest pressure recorded at the station during the month. A southwest gale of 52 miles prevailed on Pike's Peak, with light snow. 17th, the centre moved slowly eastward, preceded by brisk to high southerly winds and high temperatures in northern Texas and Indian Territory, (92° at Ft. Griffin, 4.35 p. m.) and followed by northerly winds and low temperatures from New Mexico to Dakota, (35° at Santa Fe. 11 p. m., with snow). 18th, centre moved northward from Kansas and Nebraska to southern Dakota; a terrific thunder-storm passed over Leavenworth during the early morning; during the middle of the day heavy rains fell at Corsicana, Dodge City and Lexington, and during the evening severe winds and rain-storms, as follows: Vicksburg, 7 p. m., terrific rain and wind-storm, maximum velocity, 55 miles, rainfall, 2.14 in.; Carolina Landing, (50 miles north of Vicksburg,) destructive tornado, buildings destroyed; Little Rock, heavy and destructive storm; St. Louis, very heavy wind and rain-storm, much damage, maximum velocity, at 1 p. m., NW., 60 miles; Poseyville, Ind., tornado. On the 19th heavy rains fell at New Orleans, Mobile and Punta Rassa, viz.: 3.54, 1.58 and 3.10 inches respectively; at Punta Rassa, wind NW. 36 veering to E. 32 miles, during heavy thunder-storm from 7.25 p. m. to midnight. 19th, centre moved eastward to southern Minnesota, and the area of cloud and rain extended over the Lake region; a thunder-storm, high winds and rough seas occurred on Lake Michigan. 20th, centre passed into Ontario; a severe SW. gale prevailed at New Corydon, and a terrific thunder-storm at Logansport, (1.30 a. m.), Ind.; disastrous hail and rain-storm at Wheeling, W. Va., and severe thunder-storms at Cleveland, Rochester and Toronto. Cautionary Signals were ordered up on Lakes Superior and Michigan at midnight of the 17th; Huron and Erie during the 18th, and on Ontario on the 19th. Maximum velocities, Duluth, NE. 42 miles; Milwaukee, E. 36; Port Huron, W. 36; Toledo, SW. 48; Sandusky, W. 39; Cleveland, S. 49, and Erie, S. 34. 21st, centre moved into the St. Lawrence valley; between 2 and 3 a. m. heavy thunder-storms were reported at Baltimore and Newark, and a subsidiary area, No. X, formed during the day in Virginia. During the 22d the present area passed southeastward to the Atlantic, and rains continued for several days in the Canadian maritime provinces, which were specially heavy in Nova Scotia during the 22d and 23d. Cautionary Signals were ordered on the 19th from Cape Lookout to Sandy Hook, and on the 20th from New York to Eastport. Maximum velocities, Sandy Hook, SE., 34; New London, SE. 36. On the 22d, as the storm-centre passed southeastward from the St. Lawrence valley to the Atlantic, a velocity of 81 miles per hour was recorded on the summit of Mt. Washington.

No. X.—probably formed during latter part of the 20th in West Virginia, passed southeastward during the 21st, over Virginia, and thence off the coast of North Carolina.

No. XI.—This area was first noticed in California and Nevada on the 19th, where it was accompanied by rain, and, in the mountains, snow; lowest pressure at San Francisco, 4:35 P. M., 29.68 or 0.30 below normal. 20th, rain extended to Idaho, Utah and Colorado. 21st, 4:35 P. M., lowest pressure at Portland, Or., 29.79 or 0.28 below normal.

No. XII.—During the 21st., while high-pressure area No. X was central over the Upper Lakes, easterly winds and increasing cloudiness prevailed from Texas to the Northwest; heavy rains and SE. gales prevailed in Wyoming, Colorado and western Kansas, and a severe E. thunder-storm, followed by floods, in northern Texas. 22nd, the lowest pressure was probably north of Montana and Dakota, but the barometric trough extended southward to Texas, with southerly winds; northwesterly winds prevailing at the Rocky Mountain stations. At Ft. Fetterman, a high W. wind prevailed all day, with light rain; in El Paso and Douglas Cos., Col., a terrific rain-storm, flooding all streams, and carrying away railroad bridges, &c.; on Pike's Peak, a SW. gale all day, maximum velocity, 84 miles. 23rd, lowest pressure probably in Manitoba, (Pembina, 7:35 a. m., 29.48 or 0.42 below normal); cloud and rain extended over Lake region and Ohio valley; very destructive tornadoes occurred from 3:30 to 6 p. m., at places in southern Wisconsin and

northern Illinois (which will be more fully noticed under the head of "Tornadoes"), and thunder-storms were general in the Upper Lake region. Cautionary Signals were ordered up on Lake Superior and the western shore of Lake Michigan, on the evening and midnight of the 22nd, and for eastern shore of Lake Michigan, and Lakes Huron and Erie on the 23rd. Maximum velocities, Marquette, SE., 30 miles; Milwaukee, SW., 48, and Alpena, W., 28. 24th to 27th, centre moved eastward to the Gulf of St. Lawrence, probably about as shown on the chart of storm-tracks; severe thunder-storms were reported on the 25th in North Carolina, where heavy hail did considerable damage to crops, and in New Hampshire; 26th, severe thunder-storm near Providence, R. I., and hail-storm at Cooperstown, N. Y.; On the summit of Mt. Washington, a severe thunder-storm with hail occurred, during which the wires were so powerfully affected that it was necessary to withdraw the switch cut-out; 27th, hurricane from NW., 102 miles per hour.

No. XIII—probably developed in Nevada, Utah and southern Idaho on the 27th, while high-pressure area No. VI was in Manitoba. During the latter part of the 26th the pressure fell from California to Utah, and, at 11 p. m., 27th, the lowest barometer was at Salt Lake City, (29.47, or 0.39 below normal;) cloudy and threatening weather and light rains extended thence to Dakota, Nebraska and Kansas, with high south winds in two latter. 28th, 4:35 p. m., Salt Lake City, barometer 29.50, or 0.36 below normal, with brisk to high southeast to southwest winds in Nevada and Utah. From 11 p. m., of the 28th, to 11 p. m., 29th, the barometers were lowest at Cheyenne and Denver, (ranging from 0.08 to 0.19 below normal,) and, during the afternoon of the 29th, the observer on the summit of Pike's Peak reported a southwest gale of 80 miles per hour, "blowing towards a heavy local storm over the plains about 20 miles to the northeast." During the afternoon of the 30th the centre probably moved south-eastward to western Kansas; a very severe hail-storm occurred during the afternoon at North Platte—the observer states "hail fell as large as hen's eggs, some masses of ice weighed 1½ lbs, breaking all glass on W, NW and N exposures and cutting holes in tin roofs; temperature fell 21° in 10 minutes; storm extended 15 miles in length and 5 in width." 4:35 p. m. temperature at North Platte, 62°, wind N, 24 miles; Dodge City, 92°, wind SW, 20. During the 31st, the lowest pressure remained almost stationary, but severe local storms occurred in Missouri and Illinois; Springfield, Mo., 5:15 p. m., heavy wind and rain storm—total rainfall 3.25 inches, max. vel. of wind 60 miles, veering to N, with hail. Gardner, Ill., tornado, destroying buildings. Davenport, Ia., severe thunder-storm, wind SE, 48 miles, blowing down trees &c; "during the severe wind several whirlwinds formed along the river, which gathered up the water and whirled it upward ten to twenty feet in spiral columns."

No. XIV.—During the early morning of the 29th, a severe thunder-storm prevailed in southern Iowa, accompanied by very heavy rains; six inches fell at Glenwood, Mills Co., causing heavy floods, and, during the day the barometric trough extended eastward from area No. XIII throughout the Ohio valley, in which region a distinct area of low pressure formed by morning of the 30th. This area passed over the Middle Atlantic States, during the latter part of the day, accompanied by heavy thunder-storms.

INTERNATIONAL METEOROLOGY.

April 10th, lat. 27° 30' S., 105° 48' W., violent hurricane. 11th, Bark Lilly Grace, from Pabellon de Pica for New York, reports: "experienced terrible hurricane during night, in lat. 36° S., put into Valparaiso, April 24th. 21st, 26° N., 56° W., heavy gale; 43° N., 44° W., hurricane, sea mountains high; 38° N., 60° W., heavy seas. 30th, 51° 02' N., 25° 02' W., fresh northeast to northwest winds and squalls.

May 1st, first arrival of season at Halifax, N. S., from Magdalen Islands, reported unusually mild winter, little snow and islands clear of ice until February; 48° 26' N., 31° 40' W., strong NW. breeze, squalls; 47° 01' N., 34° 38' W., heavy NW. rain-squalls; 50° 38' N., 33° 00' W., fresh NW. gale, hard squalls and heavy sea. 2nd, 46° 28' N., 38° 16' W., fresh NW. breeze and squalls; 50° 28' N., 38° 06' W., strong NNW. gale, heavy sea. 3rd., 44° 36' N., 44° 52' W., fresh SSW. gale; 43° 56' N., 46° 41' W., stormy, wind SW. much water on deck. 4th, 45° 46' N., 46° 10' W., strong W. gale; 49° 26' N., 29° 37' W., wind WSW., stormy, rain and high sea; 42° 58' N., 49° 20' W., strong WNW. and NNW. gale, high confused sea; 43° 04' N., 50° 50' W., westerly storm, much water on deck; 49° 38' N., 29° 40' W., WSW. gale, high sea; 47° 58' N., 31° 26' W., SW. gale, high sea; 50° 24' N., 19° 29' W., W. gale, rain, high sea; 51° 11' N., 29° 09' W., (7:35 a. m., Washington mean time) barometer 29.18, S. 5° W. gale and high sea. 5th, 48° 06' N., 35° 16' W., SW. to N., stormy, much rain and cross-sea. 6th, 49° 31' N., 27° 56' W., strong N. to W. gale and heavy sea; 48° 36' N., 30° 27' W. hard NW. gale and heavy sea; 51° 06' N., 16° 38' W. high NW. sea; 54° 30' N., 15° 38' W., (7:35 a. m., Wash. mean time) barometer 29.15, S. 68° E. gale with incessant rain. 7th., 47° 58' N., 35° 18' W., hard northerly gale and squalls; 49° 12' N., 19° 43' W., WNW. stormy, heavy sea; 50° 50' N., 23° 12' W., high NW. sea; 54° 50' N., 20° 59' W. strong, SE. gale and heavy rain. 9th., 47° 11' N., 35° 39' W., high seas; 49° 54' N., 39° 05' W., fresh NE. to N. gale, high N. sea. 10th, 45° 37' N., 43° 25' W., high seas; 48° 14' N., 46° 29' W., dense fog, high sea swell. 11th., 37° N., 69° W., "tornado" from NW.; 46° 10' N., 53° 15' W., dense fog and heavy rain. 12th., 43° 37' N., 58° 52' W., dense fog; 49° 42' N., 10° 10' W. and 49° 48' N., 8° 45' W., high seas. 13th., 41° 13' N., 62° 51' W., WNW., stormy; 45° 03' N., 39° 58' W., WNW. strong wind and high sea; 51° 05' N., 16° 29' W., SW. stormy, rain and high cross sea. 14th, 45° 55' N., 44° 08' W., NW. squally, high sea; 49° 55' N., 24° 47' W., WNW. rain-squalls; 48° 58' N., 23° 04' W., very heavy sea. 15th, 43° 58' N., 46° 09' W., high confused sea; 48° 00' N., 32° 30' W., high swell; 48° 07' N., 30° 58' W., NW. stormy; 49° 57' N., 5° 00' W.,

heavy rain and sea; St. George's channel, (7:35 a. m., Wash. mean time,) barometer 29.20, S. 59° W. gale. 16th, 51° 22' N., 13° 43' W., squally; 49° 39' N., 11° 50' W., heavy sea and rain-showers; 51° 29' N., 11° 51' W., (7:35 a. m., Wash. mean time,) barometer 29.20, S. 27° W. gale, increasing to whole gale and storm, with high sea-swells. 16th and 17th, 38° N.; 68° 30' W. severe hurricane; 49° 25' N., 18° 13' W., strong SW. gales, heavy sea and rain; 49° 37' N., 7° 11' W., high W. sea; schooner Belle (from Mobile, May 4th, for Havana, dismasted in squall on 17th, abandoned on the 18th, 60 miles SSE. of Key West; 18th, 51° 26' N., 15° 08' W., high sea; 48° 47' N., 25° 05' W., high sea, heavy rain showers; 51° 35' N., 25° 16' W., (7:35 a. m., Wash. mean time,) barometer 29.49, N. 25° W. gale; 49° 37' N., 12° 15' W., SW. to W. strong gale, heavy swell and high sea. 19th, 41° 38' N., 62° 01' W., NE. squall; 51° 11' N., 21° 52' W., high sea; 40° 37' N., 15° 53' W., WNW., heavy gale and high sea. 23d, 51° 03' N., 14° 22' W., W. squally; 24th, 44° 29' N., 62° 46' W., (7:35 a. m., Wash. mean time,) barometer 29.80, N. 53° E. gale; 49° 15' N., 23° 17' W., fresh N. gale and high sea; 55° 50' N., 16° 35' W., N. squalls. 25th, 50° 00' N., 20° 45' W., NW. by W. squalls.

Ice at Sea.—March 14th, 40° N., 56° W., S. S. Borussia passed large quantity of ice. 15th, 44° 30' N., 52° 25' W., S. S. Fernwood saw large iceberg and got fast in a field of drift ice; steered SE. for 5 hours to get free and during the night passed 10 large icebergs, some of which were 100 ft. high; not entirely free until she reached 47° 22' N., 47° 20' W.

April 5th, Heath Point, Anticosti Island, Schr. Mayflower caught in ice and abandoned; during night ice moved and vessel disappeared.

May 1st, 43° N., 54° W., iceberg 60 ft. high. 4th, vessels at Canso reported obliged to abandon voyage to Magdalen Islands owing to ice; large number of vessels icebound near Eastport, P. E. Islands. Bark Presto grounded on Chatham, N. B., bar. May 8th; at night the ice came down on her and crowded her up. 10th, 42° 49' N., 50° W., 5:30 a. m., small iceberg 2 miles distant.

TEMPERATURE OF THE AIR.

The isothermal lines on chart No. II show the general distribution of the temperature of the air for the month. By reference to the table in the left-hand corner of the same chart, it will be seen that the temperature over the entire country has varied but little from the normal for the month.

Minimum and Maximum Temperatures respectively: *Maine*—at Gardiner, 31°, and 72°; Cornish, 40°, 84°. *New Hampshire*—Mt. Washington, 13°, 58°; Dunbarton, 26°, 84°. *Vermont*—Burlington, 37°, 80°; Woodstock, 32°, 86°. *Massachusetts*—Springfield, 37°, 81°; Bellerica, 42°, 90°. *Rhode Island*—Newport, 40°, 73°. *Connecticut*—New Haven, 36°, 80°; Colebrook, 38°, 83°. *New York*—Waterburg, 32°, 84°; Wappinger's Falls, 36°, 86°. *New Jersey*—South Orange, 36°, 84°; Vineland, 43°, 86°. *Pennsylvania*—Tioga, 28°, 82°; Philadelphia, 43°, 88°. *De'aware*—Dover, 34°, 84°. *Maryland*—Woodstock, 32°, 83°; Owings Mills, 37°, 80°. *District of Columbia*—Washington, 39°, 87°. *Virginia*—Snowville, 32°, 88°; Dover Mines, 39°, 92°. *West Virginia*—Helvetia, 34°, 82°. *North Carolina*—Franklin, 39°, 83°; Goldsboro, 47°, 93°. *South Carolina*—Aiken, 50°, 94°; Spartanburg, 51°, 92°. *Georgia*—Gainesville, 50°, 93°; Forsyth, 58°, 94°. *Florida*—Daytona, 58°, 93°; Houston, 66°, 100°. *Alabama*—Montgomery, 52°, 94°; Mobile, 55°, 98°. *Mississippi*—Brookhaven, 52°, 92°; Fayette, 52°, 88°. *Louisiana*—Point Pleasant, 55°, 88°; Algiers, 58°, 86°. *Texas*—Clarksville, 51°, 91°; Ferrill, 62°, 98°. *Ohio*—Hillsboro, 41°, 79°; College Hill, 44°, 83°. *Kentucky*—Danville, 42°, 81°; Bowling Green, 46°, 89°. *Tennessee*—McMinnville, 47°, 88°; Austin, 42°, 91°. *Arkansas*—Mt. Ida, 48°, 88°; Judsonia, 50°, 90°. *Michigan*—Detroit, 30°, 79°; Litchfield, 45°, 74°. *Indiana*—New Harmony, 40°, 84°; Laconia, 45°, 88°. *Illinois*—Louisville, 37°, 87°; Como, 35°, 83°. *Missouri*—Wet Glaze, 30°, 87°; St. Louis, 29°, 97°. *Kansas*—Manhattan, 33°, 85°; Independence, 48°, 90°. *Wisconsin*—Neillsville, 22°, 66°; Beloit, 34°, 80°. *Iowa*—Ames, 38°, 71°; Logan, 32°, 88°. *Nebraska*—Clear Creek, 36°, 83°; Norfolk, 40°, 80°. *Minnesota*—Breckenridge, 29°, 78°; St. Anthony, 37°, 80°. *Dakota*—Olivet, 28°, 84°. *Colorado*—Denver, 32°, 87°; Ft. Lyon, 33°, 91°. *Wyoming*—Ft. Sanders, 10° 71°; Cheyenne, 28°, 76°. *Utah*—Salt Lake City, 34°, 83°. *Nevada*—Winnemucca, 28°, 83°. *California*—Los Angeles, 47°, 89°; San Francisco, 48°, 78°; Visalia, 45°, 97°. *Arizona*—Yuma, 52°, 105°.

Ranges of Temperature.—The monthly ranges will appear from examination of the minima and maxima temperatures just given.

Greatest daily ranges—vary in New England from 22°, least on Mt. Washington, to 32° at Boston; Middle Atlantic States, 19° at Cape May to 34° at Fort Whipple, Va.; South Atlantic States, 17° at Cape Hatteras to 31° at Augusta; East Gulf States, 22° at Key West to 29° at St. Marks; West Gulf States, 18° at Galveston to 29° at Shreveport; Ohio valley and Tennessee, 22° at Cairo to 34° at Knoxville; Lower Lake region, 22° at Oswego to 27° at Detroit, Erie and Rochester; Upper Lake region, 20° at Chicago and Grand Haven to 36° at Marquette; Upper Mississippi valley, 26° at Dubuque to 35° at St. Paul; Lower Missouri valley, 31° at Omaha to 39° at Yankton; Minnesota and Dakota, 34° at Bismarck to 43° at Pembina; Colorado, 27° on Pike's Peak to 42° at Denver; Utah and Nevada, 30° at Salt Lake City to 42° at Winnemucca; California, 26° at San Francisco to 40° at Red Bluff.

Frosts occurred as follows: *Maine*—14th to 16th, (17th, injured vegetation.) *New Hampshire*—7th, 13th, 15th, 17th; on Mt. Washington, 5th to 18th, 20th to 30th. *Vermont*—7th to 9th, 14th, 15th, 17th, 18th, 24th. *Massachusetts*—7th, (13th, injured vegetation,) 17th. *Connecticut*—11th to 14th. *New*

York—6th, 7th, (13th to 17th, injured vegetation,) 18th, 23rd. *New Jersey*—11th, (13th, 14th, injured vegetation,) 16th. *Pennsylvania*—10th, 11th, 12th, (13th, 14th, 16th, injured vegetation,) 23rd, 29th, 31st. *Delaware*—(16th, injured vegetation,) 23rd. *Maryland*—4th, (13th, injured vegetation,) 15th and 23rd. *Virginia*—6th, 11th, (13th, 16th, injured vegetation.) *North Carolina*—5th, 6th, 10th, 11th, (16th, injured vegetation.) *Kentucky*—10th, 11th, 13th, 15th. *Ohio*—5th, 6th, 8th to 12th, (13th, 16th, injured vegetation.) *Indiana*—6th, 11th, 12th, (13th, injured vegetation,) 14th, 15th, 27th. *Illinois*—4th, 9th, 10th, (11th, 12th, 13th, injured vegetation.) *Michigan*—4th to 6th, 10th to 17th, 28th to 30th. *Wisconsin*—6th, 10th, 12th, (13th, injured vegetation,) 30th. *Minnesota*—3d, 4th, 10th to 13th. *Iowa*—3d to 5th, 10th, (11th, 12th, 13th, injured vegetation,) 17th, 27th. *Missouri*—3d, 4th, (10th, injured vegetation,) 15th. *Kansas*—4th, 10th, 14th. *Nebraska*—3d, 4th, (10th, injured vegetation,) 12th. *Dakota*—1st to 15th, 21st, 27th to 29th. *Wyoming*—3d, 8th, 10th. *Colorado*—8th, 10th. *Utah*—7th, 8th. *New Mexico*—3d, 4th, 18th.

Ice is reported to have formed as follows: *Dakota*, at Olivet, 9th, $\frac{1}{4}$ in., 12th, $\frac{3}{4}$ in.; Bismarck, 2d, $\frac{1}{2}$ in. *Missouri*—10th. *Nebraska*—4th, 10th to 12th. *Iowa*—4th, 11th to 14th, 16th. *Wisconsin*—10th, 12th, 13th. *Michigan*—13th to 15th. *Indiana*—12th. *Ohio*—4th to 6th, 13th, 14th. *Pennsylvania*—12th, 13th, 14th, 16th. *Virginia*—16th. *New Jersey*—12th to 14th. *New York*—13th, 14th, 16th. *Connecticut*—12th to 16th. *Massachusetts*—13th, 14th. *Vermont*—12th, 15th. *New Hampshire*—13th.

PRECIPITATION.

In General.—The general distribution of rain (and melted snow) for the month is shown on chart No. III. Fillmore City, Utah, and Kit Carson, Col., (Sun-set stations,) report 10.30 and 13.25 inches rain-fall, respectively; but these figures are probably incorrect. By reference to the table in the lower left-hand corner of the same chart it will be seen that the rain-fall for the month has been considerably above the normal in the Southwest, Lower Missouri valley, Eastern Gulf and Middle Atlantic States, and decidedly below normal in New England.

Special Heavy Rains.—2nd, Judsonia, Ark., 2.75 inches; Mt. Ida, Ark., (2nd, 3rd,) 3.35 in. 3rd, Brookhaven, Miss., 2.30 in. 5th, Wappinger's Falls, N. Y., (4th, 5th,) 2.30 in.; Ardenia, N. Y., (4th, 5th,) 2.11 in.; Wilmington, N. C., (4th, 5th,) 2.30 in.; Colebrook, Conn., (4th, 5th,) 2.30 in.; Mt. Washington, 2.87 in.; Dover Mines, Va., (4th, 5th,) 2.25 in.; Mt. Solon, Va., (4th, 5th,) 2.10 in. 8th, Point Pleasant, La., 2.06 in. 10th, Brackettville, (10th, 11th,) 3.59 in. 12th, Lawrence, Kan., (11th, 12th,) 2.05 in.; Wet Glaze, Mo., 2.00 in.; Austin, Tex., 2.80 in.; Castroville, 2.16 in.; Fredericksburg, 3.00 in. 14th, Fort Monroe, Va., 2.02 in.; Brackettville, 2.28 in.; Cape Henry, 2.27 in. 15th, Accotink, Va., (14th, 15th,) 2.00 in.; Cape Henry, (14th, 15th,) 3.02 in.; Independence, Kan., 2.08 in. 17th, New Orleans, 2.05 in.; Independence, Kan., (17th, 18th,) 2.20 in. 18th, Louisville, Ill., (18th, 19th,) 3.00 in.; Vicksburg, 2.14 in.; Corsicana, 2.35 in.; Kansas City, Mo., 2.00 in.; Wet Glaze, Mo., 2.30 in.; Fayette, Miss., (18th, 19th,) 2.50 in. 19th, Algiers, La., (19th, 20th,) 4.00 in.; New Orleans, 3.54 in.; Macon, Miss., (18th, 19th,) 2.25 in.; Deadwood, D. T., (18th, 19th,) 3.68 in. 20th, Fayetteville, N. C., 2.50 in. 21st, Goldsboro', N. C., 3.75 in.; Clarksville, Tex., (20th, 21st,) 6.50 in. 22nd, Dodge City, (21st, 22nd,) 3.30 in.; Fort Gibson, 2.52 in.; near Genoa, Neb., 2.30 in. Judsonia, Ark., (24th, 25th,) 2.25 in.; Independence, Kan., (22nd to 25th,) 4.12 in. 27th, Charleston, S. C., 3.48 in. 29th, Logan, Iowa, 2.50 in.; De Sota, Neb., 3.88 in.; Glenwood, Mills county, Iowa, 6.00 in. 30th, Hennepin, Ill., 2.90 in. 31st, Wood's Holl, (30th, 31st,) 3.53 in.; Brookhaven, N. Y., (30th, 31st,) 4.03 in.; Newport, 3.80 in.; Atlantic City, (30th, 31st,) 4.69 in.; Mystic, Conn., 2.00 in.; Lebanon, Mo., 1.44 in., (in 45 minutes;) Springfield, Mo., 3.25 in.

Largest Monthly Rain-falls.—At Glenwood, Iowa, 12.00 inches; Springfield, Mo., 11.75 in.; near Independence, Kan., 10.06 in.; Clarksville, Tex., 10.25 in.; Judsonia, Ark., 9.85 in.; Wet Glaze, Mo., 9.50 in.; Lebanon, Mo., 9.39 in.; Mt. Washington, 9.28 in.; Algiers, La., 8.90 in.; Henrietta, Tex., 8.33 in.; Deadwood, Dak., 7.80 in.; Fayetteville N. C. 7.60 in., and Goldsboro, N. C., 7.50 inches.

Smallest Monthly Rain-falls.—At Florence, Tucson, Camp Grant and Yuma, in Arizona, and Monterey and Santa Barbara, Cal., none; Visalia, Cal., 0.08 in.; San Francisco, 0.16 in.; Concho, Tex., and Sacramento, Cal., 0.17 in.; Burkes, Arizona, 0.21 in.; Contoocookville, N. H., 0.30 in.; Prescott, Arizona, 0.33 in.; Umatilla, Or., 0.35 in.; and Campo, Cal., 0.41 inches.

Floods.—8th, at Riley, Ill., heavy rains, fields badly flooded, crops injured. 12th, Castroville, Tex., heavy rain storm, streams swollen damaging crops and fences. 19th, New Orleans, heavy rains, streets flooded two feet deep. Cherry Creek, Col., heaviest flood since 1864 caused by heavy rains on the divide at head of Creek, 52 miles south of Denver; all bridges (seven in number) were swept away, lower part of Denver flooded, rail roads damaged and crops and fences washed away. 21st, Denison, Tex., trains delayed by heavy rains for the past three days; track flooded and bridges washed away. 22nd, Deadwood, Dak., freshets, four houses washed away near the placer mines. The Missouri river, at Omaha, on the 25th, overflowed its banks; 26th, portion of B. & M. railroad track partly covered; 27th to 29th, flats covered in all directions; railroad tracks, along river, submerged; Omaha Smelting and Refining Works in positive danger. 29th, in southwestern Iowa, severe thunder-storm, with excessive rain, causing the Nishuabaton river to overflow its banks; bridges almost impassable; the Missouri river, in this section, arose above its banks, destroying crops on the bottom lands. 29th, De Sota, Neb., heavy rains; bridges washed away.

Droughts.—Houston, Fla., month very dry, impeding the growth of vegetation.

High Tides.—15th, Atlantic City, N. J., severe NE. gale; high tide, sweeping railroad track. 16th, Charleston, unusually high tides. Cape Lookout, very high tide. 30th, Sandy Hook, very high tides, injured jetties.

Hail.—2d, Tex. Kan.; 3d, Wy. T., Ohio; 4th, Ohio; 5th, Ohio, N. C., Va.; 6th, N. C.; 7th, Kan., Neb., Ind. T., Tex., Tenn., Ill., Iowa; 8th, Wy. T., Tex., Ill., La., Miss.; 9th, Mich., Pa.; 10th, Col., Wy. T., Minn., Ohio, Mich., Ind., Pa.; 11th, Col., W. Va., Ohio, N. Y., Va., R. I., Conn., Wy. T., Ill., Mass., N. J., Pa., Vt.; 12th, Ind., Neb., N. H., N. Y.; 13th, Mass., Me., N. Y., Vt.; 15th, Col.; 16th, Fla.; 17th, Col., Mo., Neb.; 18th, Col., Tex., Miss., Iowa, Ark., Kan., N. J.; 19th, Kan., Iowa, Mich., Minn., Ill., Ky., Wis.; 20th, W. Va., N. Y., Pa.; 21st, Va., Wv. T., N. J., Pa.; 22d, Neb.; 23d, Minn., Ind. T., Ill., Iowa, Kan.; 24th, Va., Wis.; 25th, N. M., Iowa, Ky., Me., Vt.; 26th, Tex., N. H., Me., N. Y., Vt.; 27th, Me., Vt.; 28th, Kan., Iowa, Mass., Neb.; 29th, Kan.; 30th, Neb., Iowa, Md.; 31st, Fla., Iowa, Mo.

Rainy Days.—The number of days on which rain or snow has fallen varies as follows: New England, 6 to 21; Middle Atlantic States, 12 to 17; South Atlantic States, 5 to 13; Gulf States, 5 to 11; Ohio valley and Tennessee, 12 to 18; Lower Lake region, 11 to 19; Upper Lake region, 10 to 18; Upper Mississippi valley, 11 to 21; Lower Missouri valley, 11 to 15; Northwest, 10 to 19; Western Plains, 8 to 15; Rocky Mountains, 6 to 23, and Pacific coast, 3 to 11.

Cloudy Days.—For New England, the number varies from 6 to 21; Middle Atlantic States, 5 to 14; South Atlantic States, 2 to 9; Gulf States, 4 to 13; Ohio valley and Tennessee, 3 to 11; Lower Lake region, 7 to 13; Upper Lake region, 7 to 12; Upper Mississippi valley, 7 to 17; Lower Missouri valley, 14 to 16; Northwest, 10 to 21; Western Plains, 13 to 18; Rocky Mountains, 2 to 8, and Pacific coast, 3 to 17.

Snow fell as follows: New Hampshire, 12th, 13th; Vermont, 12th, 14th; Massachusetts, 11th, 13th, 14th; Connecticut, 15th; New York, 12th; New Jersey, 11th; Pennsylvania, 11th; Ohio, 10th; Michigan, 4th, 10th to 12th, 14th, 15th; Wisconsin, 4th, 11th; Minnesota, 3rd, 10th; Iowa, 3rd, 11th, 12th; Nebraska, 11th, 12th, 17th; Dakota, 2nd, 3rd, 11th, 12th; Wyoming, 2nd, 6th to 8th, 16th to 19th; and, in Colorado, on Pike's Peak, 1st to 3rd, 6th, 7th, 12th, 14th, 15th, 18th to 21st, 24th, 25th; snow on summit, at end of month, 30 inches, and in gulches 60 feet deep; New Mexico, 17th; Utah, 16th, 17th; Nevada, 12th to 14th, 20th, 21st, 22nd, 28th, 31st.

RELATIVE HUMIDITY.

The average percentage of relative humidity for the month ranges as follows: New England, 59 to 78; Middle Atlantic States, 60 to 77; South Atlantic States, 59 to 80; East Gulf States, 67 to 75; West Gulf States, 61 to 77; Lower Lake region, 61 to 71; Upper Lake region, 64 to 75; Ohio valley and Tennessee, 58 to 67; Upper Mississippi valley, 57 to 70; Lower Missouri valley, 63 to 65; Red River of the North valley, 59 to 67; Eastern slope, from Dakota to interior of Texas, 45 to 72; Western plateau, 34 to 50; California, 48 to 75. High stations report the following: Mt. Washington, 91; Pike's Peak, 63; Cheyenne, 58; Denver, 47; Santa Fe, 24.

WINDS.

The prevailing winds at Signal Service stations are shown by arrows, flying with the wind on chart No. II. East of the Mississippi the prevailing direction is westerly; in the Southwest, southerly, and in the Northwest, northwesterly. The maximum velocities have already appeared under the description of storm-areas.

Total Movements of the Air.—The following are the *largest* monthly movements as recorded at the Signal Service stations, viz: Pike's Peak, 20,276 miles; Cape Lookout, 11,918; North Platte, 11,055; Cape May, 10,467; Kittyhawk, 10,465; Indianola, 10,454; Breckenridge, 10,134; Dodge City, 10,064; Sandusky, 9,839; Sandy Hook, 9,764; Decatur, 9,742, and Cape Hatteras, 9,741. The total movements is not recorded on Mt. Washington, but velocities exceeding 70 miles per hour occurred on six days. The *smallest* are: Deadwood, Dak., 2,226 miles; Campo, 2,378; Lynchburg, 2,499; Roseburg, 2,759; Visalia, Cal., 2,892; Boerne, Tex., 2,981; Brackettville, Tex., 3,354; Nashville, 3,425; Augusta, 3,450; Los Angeles, 3,459; Shreveport, 3,479; Montgomery, 3,520; Knoxville, 3,770; Springfield, Mass., 3,925.

Tornadoes, accompanying storm-area No. XII. The following notes on the severe tornado of the 23rd, in southern Wisconsin, will serve to show the course of the storm. It was probably first noticed by an observer situated in a valley about ten miles west of Mineral Point, who states, "that he saw the cyclone traveling at the rate of about five miles an hour—it seemed to gather strength as it moved—when it struck the hill it shot off in the direction of Mineral Point, and after it had passed him he could hear it roar miles away." Prof. Hinrich's reports, "tornado-cloud observed during p. m., 23d, in Jones Co., Iowa," and states in Iowa Monthly Weather Review, "probably the same which, a few hours later, came down to earth's surface in Wisconsin, near Mineral Point." The storm entered Mineral Point, Iowa Co., from the SW., and passed along a ridge of ground extending over $\frac{1}{2}$ of a mile in width; it then struck a two-story frame house, containing 13 rooms, completely demolished it, and carried one of the inmates 400 feet in the air, and then dashed her to the ground dead; a rafter from this house was found one mile distant, driven over five feet in the ground. A large barn 300 feet NW. of this house was also demolished, and carried in an opposite direction to the passage of the cy-

clone. Immense damage was done to the property in this vicinity, and a number of persons killed and wounded; "a barn and horse were carried completely away, and neither horse, barn, nor any portion of either, have since been found." "About 2½ miles E. of city a school-house was carried away, with the teacher and scholars. The teacher was badly injured and two scholars killed." The cyclone then passed eastward over the southern portion of Dane Co.; at Perry, houses and barns were totally demolished—many persons killed. At Primrose, (about 4 p. m.) houses and barns were totally demolished, many persons killed; hail size of tea-cups, breaking glass on W. and N. exposures; rain fell in torrents, flooding fields and sweeping away fences. Verona Corners and vicinity, severe hail-storm, breaking all glass on W. exposures; hail-stones eight inches in circumference; streams in vicinity flooded. Montrose, houses destroyed. Oregon Cemetery, monuments shattered and number of plain stones broken off. Fitchburg, (7 or 8 miles SW. of Madison) farm house carried entirely away, track of storm 2 miles wide. From Primrose, (25 miles SE. of Madison,) through Mt. Vernon to Paoli, wide-spread damage is reported, 12 to 15 persons killed. Near Oregon, 2 horses carried 100 ft. and dashed to earth, killing them instantly—storm raised from the ground 7 or 8 miles SW. of Madison; again struck ground near Ft. Atkins, NE. of Madison. Near Primrose and Paoli the storm seemed from a ¼ to 1 mile in width. Madison, 4 to 4:30 p. m., cyclone from SSW., buildings destroyed; during the heavy rain, the air was suddenly observed to be filled with falling leaves, small twigs, shingles, laths and large sticks, (one board measuring 8 ft. long and 1 ft. wide, seemingly to have been wrenched from a house,) all filling the air as high as the eye could reach, and falling straight to the earth. "In the outskirts of the storm-belt, there appeared to be two strata of clouds, the lower a heavy mist, through the occasional breaks of which could be seen the upper layer of heavy black clouds, snarled, tangled and quivering, from which was discharged all kinds of debris." No notes have yet come to hand from the east portion of Dane Co., but the cyclone entered Jefferson Co. about 5:15 p. m., where the "tornado struck the earth at Cedar Lake," passing eastward; average width of path, 30 rods, although, in places, half mile wide; left the earth again at Bulkwinklesville, sixteen miles east of Cedar Lake. Eye-witnesses state that the water in west end of Cedar Lake was lifted up two hundred feet, leaving bottom of lake clearly visible. Oakland, houses and barns destroyed, persons killed and injured; track one mile wide, damage done in less than three minutes; in Rome and Hebron, barns were blown down and unroofed. The storm then entered Waukesha Co., commencing about 5 p. m. at Waukesha, and lasting about two hours; wind blowing in all directions; houses unroofed, sidewalks torn up, trees and fences blown down. Milwaukee, 6:42 to 7:35 p. m., severe tornado, path of greatest severity from SSW. to NNE. and very narrow; buildings blown down; tornado appears to have dissipated over Lake Michigan. Barrington, Cook co., Ill., terrific storm: about 6 p. m., the storm-cloud was observed approaching from SW., accompanied by an almost indescribable noise; when about 200 yards from observer it struck the ground, with a deafening noise, and seemed to rest a moment; then rose in air about 55 feet, carrying up a mass of earth, trees and debris; it again descended, and striking the side of a farm house, carried it up, whirling it over and over, and completely demolished it at an elevation of about 150 feet. The inmates were all killed, and the observer had to hold on to the grass with his full strength to keep from being drawn into the vortex. The storm-cloud was observed advancing at a distance of four miles, and after destroying other buildings passed over in a northeasterly direction; in several places, where the storm struck the ground, it would carry up earth, &c., and leave a hole from 150 to 300 ft. square. About 6:30 p. m., a SW. hurricane prevailed at Highland Park, (on the Lake shore,) followed by huge hail-stones, 3½ inches in diameter, resulting from the meeting of two storms from the NW. and SW.; belt of hail ½ mile wide; laths and debris fell before the hail, the whole lasting from 15 to 20 minutes; huge hail also fell at Riverside, Winnetka and Park Ridge. Tornado in Adams and Brown Cos., Ill.; appeared about 6:30 p. m. about 1 mile south of Mound station, coming from W. and passing a little S. of E.; houses and barns carried away, horses, cows, &c., killed, and persons injured.

Waterspout.—26th, Decatur, Tex., 4:45 p. m., waterspout passed southward down Sandy Creek, tearing up trees, fences, &c.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather indications with the telegraphic reports for the succeeding twenty-four hours shows a general percentage of omissions of 0.2 per cent., and of verifications of 83.2 per cent. The percentages of verifications for the four elements have been: Weather, 87.6; Wind, 86.6; Temperature, 82.1; Barometer, 76.6. The percentages of verifications by geographical districts have been: New England, 84.0; Middle States, 86.6; South Atlantic States, 84.6; East Gulf States, 82.3; West Gulf States, 80.9; Lower Lake region, 84.8; Upper Lake region, 83.5; Tennessee and Ohio valley, 82.5; Upper Mississippi valley, 82.7; Lower Missouri valley, 80.6. Of the 3,713 predictions that have been made, 139, or 3.7 per cent., are considered to have entirely failed; 120, or 3.2 per cent., were one-fourth verified; 592, or 15.9 per cent., were half verified; 390, or 10.5 per cent., were three-fourths verified; 2,472, or 66.7 per cent., were fully verified, so far as can be judged from the weather maps.

Cautionary Signals.—During the month 228 Cautionary Signals were displayed; 151, or 66.2 per cent., were justified by subsequent hourly velocities of 25 miles and over, at or within 100 miles of the station. Four signals were late and two were lowered too early; 77 were not justified.

NAVIGATION.

Stages of Water in Rivers.—In the table, on the right hand side of chart No. III, are given the highest and lowest readings of the Signal Service river gauges during the month, with dates of same. At Omaha the Missouri rose ten inches above the danger-line on the 28th and 29th, and the consequent damage is noticed under the head of floods. At Vicksburg the Mississippi was within six inches of the "danger-line" from the 8th to the 14th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms.—1st, Ill., Ind., Iowa, Kan., Mo., Neb., N. J., Mich. 2nd, Kan., Ark., Ill., Iowa, Kan., Mo., Tex., Va., Neb., Ind. T., Ohio, Ind. 3rd, Ark., Fla., Kan., La., N. Y., Ohio, Tex., Va., Miss., Ala., Tenn. 4th, Me., N. J., N. C., Ohio, Pa., Vt., Va., Ala., Fla., Tenn., Md. 5th, N. J., N. C., Va. Dak., W. Va., Tenn., Ga. 6th, Ind. T., Wy. T., Col., N. C. 7th, Mich., Ark., Ill., Ind., Iowa, Kan., Ky., Neb., N. Y., Ohio, Pa., Tex. 8th, N. M., N. Y., Ark., Ill., Ind., Ky., La., Mich., Neb., N. C., Ohio, Pa., Tenn., Tex., Va., Miss., Ala., Wis., W. Va. 9th, N. Y., Tex., Va. 10th, Ind., Mich. Pa., Va., Tex., W. Va., Va., Me. 11th, Wy. T., Dak., Me., Neb., Vt., Tex. 12th, Fla., Col. 13th, Ind. Ty., Ark., Fla., Tex., Miss., Tenn. 14th, Ga. 15th, Ind. Ty., Dak., Kan., Mich., Neb. 16th, Fla., Ky., La., Ala., 17th, Kan., Wy. T., Ill., Iowa, Mo., Neb., N. C., Ind. T., Miss., La. 18th, Mich., Ark., Ill., Ind., Iowa, Kan., Ky., La., N. Y., Ohio, Tex., Miss., Mo., Minn., Tenn., N. C., Fla. 19th, Minn., Ill., Ind., Iowa, Kan., Ky., La., Mich., Neb., N. Y., Ohio, S. C., Tenn., Cal., Ala., Wis., Fla., Ga. 20th, Ill., Ind., La., N. Y., Ohio, Pa., Tex., Wis., Nev., Col., Ala., Mich., W. Va. 21st, Ind. Ty., Me., Va., Wy. T., Ark., Del., Ill., Kan., Ky., La., Md., N. J., N. Y., Pa., S. C., Tex., Va., W. Va., Ala., Fla., Ga. 22d, Ark., Dak., Fla., Ill., Kan., Neb., N. J., Ind. T., Minn. 23d, Ind. T., Mich., Neb., Fla., Ill., Iowa, Kan., Mich., Va., Wis., Dak., Mo., Minn., Ga. 24th, N. M., N. Y., Wy. T., Ark., Ill., Ind., Kan., Md., Mich., Pa., Tenn., Va., Mo., Ohio, W. Va., N. C. 25th, Dak., Ill., Kan., Ky., Mass., N. H., N. C., Tenn., Vt., Va., Col., Tex., Ind. Ty. 26th, Ill., Iowa, Mass., N. Y., N. C., Pa., Tex., Vt., Va., S. C., Ga., N. H. 27th, Dak., La., Me., S. C., Vt., Col., Wy. T., Neb., Ala., Miss., Ga. 28th, Ind. Ty., Dak., Ill., Iowa, Neb., Kan., N. C., Mass. 29th, Fla., Ill., Ind., Iowa, Kan., Mo., Wy. T., Neb., Dak., Fla. 30th, Ind. Ty., Neb., Va., Dak., Del., Ill., Iowa, Md., Mo., N. J., N. C., Tenn., Tex., Va., W. Va., Fla., Minn. 31st, Minn., Fla., Ill., Iowa, Mo., Neb., Pa., Ind. T.

Auroras.—Washington, D. C., 11th; Burlington, Vt., 18th; Detroit, Mich., 24th; Oswego, N. Y., 26th, 30th.

Magnetic Phenomena.—Prof. G. Hinrichs, Iowa City, Iowa, reports the average magnetic diurnal range in declination as 8.36 minutes.

Telegraphic Communication Interfered with by Atmospheric Electricity.—Pike's Peak, Col., 7th, heavy thunder-storm, compelled to cut out wires; 12th, wires cut out, but sparks would still pass between windows; 22nd, severe electricity, had to cut out wires; 26th, intense electricity. Santa Fe, N. M., 9th, intense, 17th, 24th and 25th. Norfolk, Va., 30th, wires badly affected, cable arrester at Lynn Haven fused by lightning. Mt. Washington, 26th, wires powerfully affected, compelled to withdraw switch cut-out.

OPTICAL PHENOMENA.

Solar Halos.—1st, N. Y. 2nd, N. Y., Iowa, Me., Ohio. 4th, S. C. 5th, Cal., R. I., Me., N. Y. 6th, Ohio, Ky., R. I., Me., Mass., Conn., Ill., Ind., N. H., N. Y. 7th, R. I., Iowa, Conn., Dak., Mass., N. H., N. J., Ohio. 8th, Ohio, Conn. 9th, La., Miss. 10th, Miss. 11th, Cal., S. C., Ga., Miss. 12th, Cal., S. C., Ga. 13th, Ohio, Ill., Ind., Iowa, Md., W. Va. 14th, Fla., Minn., Ohio, N. J., Ill., N. Y., Pa. 15th, Tex., Ky., Iowa, Conn., Ind., Mass., N. H., Miss. 16th, Cal., Ohio, S. C., Ga., N. H., N. J., Md. 17th, R. I., Ill., Iowa, Mich., N. H., N. Y. 18th, Mich., Ohio, Me., Ind. 19th, N. H., Mass. 20th, N. H., Va. 21st, Cal., Conn., N. Y., Miss. 22nd, Iowa, Ohio, Ky., Ga., Ind., Miss. 23rd, Ala., Tenn., Miss. 24th, Ohio, R. I., Ark., Ill., Ind., N. H. 25th, Ohio, Mich., Tenn., R. I., Conn., Iowa, Vt., Miss. 26th, Ohio, Conn., Tex., Vt. 27th, Cal., Ohio, Md., N. J. 28th, Cal., Ohio. 29th, Cal., Dak., Ohio, Iowa, N. J., Pa., 30th, Cal., Dak. 31st, Nev., Wis.

Lunar Halos.—1st, Mich. 3rd, N. Y. 5th, Minn., Conn. 6th, Dak., Neb., Iowa, Mo., Ind., Me., Ohio, Pa. 8th, S. C., N. J., N. C. 9th, Col., Tex., Ala., Fla., Miss., Mo., Minn. 10th, Wy. Ty., Nev., Kan., Tex., Fla., Miss., Mo., Minn., La., Wis. 11th, Col., Neb., Tex., La., Miss., Minn., W. Va., N. C., Ga., Mass. 12th, Nev., Dak., Ind. Ty., La., Minn., S. C., N. C., Ga., Iowa, N. J. 13th, Dak., Tex., Mich., Wis., Ohio, N. Y., W. Va., Pa., Conn., Ill., Ind., Iowa, Mass. 14th, Kan., Tex., Fla., Minn., Mich., Ohio, N. Y., R. I., Mass., Conn., Pa. 15th, Wy. Ty., La., Tex., Fla., Wis., N. Y., Ind., Ohio, Ky., Va., W. Va., Miss. 16th, Kan., N. Y., N. J., Pa. 17th, Mich., N. Y., Ind., S. C., R. I., Mass., Conn. 21st, Ind. Ty. 24th, La., Ill. 28th, Neb., Ind. Ty. 29th, Dak., Ind. Ty.

Mirage.—Olivet, Dak., 1st; New London, Conn., 6th, 7th, 24th.

MISCELLANEOUS PHENOMENA.

BOTANICAL.—Arkansas—Judsonia, ripe, 19th, blackberries; 25th, wheat; 26th, peaches ripening. Connecticut—New London, in bloom, 25th, snow-ball; leafing, 26th, polonia: Dakota—Olivet, all crops look favorable. Florida—Milton, in bloom, 21st, early corn; 31st, green corn fit for use.

Georgia—Savannah, in bloom, 1st, magnolia. Illinois—Riley, 7th, planting corn. Iowa—Fort Madison, in bloom, 2nd, snowballs; 3rd, rose, spirea; 13th, locust; Monticello, in bloom, 1st, lilacs; 4th, snowballs; ripe, 20th, strawberries; Guttenberg, wheat injured by the chintz bug; grass in fine condition; Nora Springs, in bloom, 4th, lilacs; 20th, dandelions, strawberries, apples, mandrake; Vail, corn poor; small grains looking well. Indian Territory—Ft. Gibson, ripe, 26th, cherries, blackberries; 28th, whortleberries. Kansas—Independence, ripe, 22nd, barley; 27th, wheat; 13th, cherries; 25th, raspberries, dewberries; 27th, currants; 31st, gooseberries; 30th, oats heading. Maine—West Waterville, in bloom, 7th, plum, cherry; 10th, apple; Cornish, in bloom, 2nd, shadbush; 5th, cherry; 8th, pear; 11th, apple; 13th, blueberry; 18th, horse-chestnut; leafing, 3rd, forest trees, horse-chestnut. Massachusetts—Somerset, in bloom, 1st, pear, buttercups; 5th, wild columbine; 8th, apple; 12th, quince, lilac; 17th, bush honeysuckle; 20th, spirea; Waltham, in bloom, 1st, shad bush; 3rd, white birch; 4th, blue berry; 5th, apple; 4th, pear; 7th, sassafras; 16th, lilac; 23rd, cherry; 24th, horse chesnut; 25th, barberry; 27th, white thorn; 29th, blackberry; Fall River, in bloom, 1st, pear; 6th, apple; New Bedford, in bloom; 8th, dogwood; 10th, lilac; 20th, hawthorn; leafing, 9th, oak; Rowe, in bloom, 6th, cherry; 12th, apple. Michigan—Northport, fruit prospects favorable, hay and grain promise well; in bloom, 7th, cherry; 8th, plum, 9th, pear. Mississippi—Brookhaven, in bloom, 2d, lillies; 4th, persimmon; 5th, jessamine and magnolia; 20th, early corn; 26th, early cotton; ripe, 26th, oats; 10th, plums, whortleberries; 13th, blackberries; 12th, cherries; 31st, crops very promising. Missouri—St. Louis, ripe, 5th, strawberries; Louisiana, ripe, 31st, raspberries; Mississippi county, 12th, wheat harvested; Sikeston, 24th, wheat harvested; Butler county, 29th, 30th, wheat harvested; Mexico, in bloom, 3d, wheat; Lebanon, ripe, 26th, cherries; 30th, blackberries. New Hampshire—Contoocookville, in bloom, 8th, pear, currant, strawberry; leafing, 8th, grape. New Jersey—Newark, in bloom, 5th, horse-chesnut. New York—Wappinger's Falls, in bloom, 10th, tulips; 14th, horse-chesnut; 18th, rye, roses; 20th, peonies; ripe, 18th, maple seeds; 21st, strawberries; leafing, 2d, maple; 14th, locust; 2d, grass sufficient for pasture, oats up; Palermo, in bloom, 3d, apple; 10th, lilac; 16th, horse-chesnut; 27th, yellow daisies; 30th, blackberry; 8th, planting corn; Nile, in bloom, 10th, apple; Waterburg, in bloom, 1st, pear, apple. North Carolina—Fayetteville, in bloom, 1st, magnolia; ripe, 14th, raspberries; Weldon, cotton seed rotting in ground, because of cold, damp weather. Ohio—Margaretta Township, in bloom, 2nd, quinces; Ringgold, grass growing slowly; fruit prospects good; wheat the most forward for many years; potatoes very much advanced. Pennsylvania—Egypt, in bloom, 1st, apple; 6th, quince; Carlisle, heading, 8th, wheat; 28th, oats. Tennessee—Nashville, 11th, cotton and other crops fifteen days early. Texas—Clarksville, 31st, corn looks well; wheat harvested and oats ripe; cotton injured by wet weather; Melissa, wheat harvested, several days earlier than for many years; 31st, corn in tassel, never known here so early before; notwithstanding the season has been cool, crops are further advanced than for twenty-six years. Virginia—Wytheville, ripe, 25th, strawberries; 30th, cherries, new potatoes; near Keswick, 31st, oats in fine condition; corn 12 to 18 inches high; cherries ripe; crops well advanced; near Johnsontown, in bloom, 1st, roses. Vermont—West Charlotte, in bloom, 1st, cherry; 7th, dandelions; Strafford, in bloom, 6th, plum; 9th, wild cherry; 15th, apple; Woodstock, in bloom, 3rd, plum. Wisconsin—Embarrass, in bloom, 1st, strawberry; 2nd, apple, wild cherry, wild gooseberry; Wautoma, in bloom, 11th, lilac; 31st, roses; 31st, small grain looks very well; Milwaukee, in bloom, 19th, mandrake, ivy and locust; leafing, 19th, poplars.

BIRDS.—*Wild Geese*: Cornish, Me., 1st; Wappinger's Falls, N. Y., 1st. *Kingbird*: Monticello, Iowa, 21st; Cornish, Me., 8th; Waltham, Mass., 11th; Rowe, Mass., 8th; Plattsmouth, Neb., 2nd; Palermo, N. Y., 18th; West Charlotte, Vt., 21st; Embarrass, Wis., 7th. *Swallows*: Monticello, Iowa, 24th; Cornish, Me., 1st; Plattsmouth, Neb., 4th; Woodstock, Vt., 1st; Embarrass, Wis., 2nd. *Robins*: Clear Creek, Neb., 13th. *Cuckoo*: Contoocookville, N. H., 24th; Palermo, N. Y., 23rd; Strafford, Vt., 25th; Embarrass, Wis., 14th. *Orioles*: Cornish, Me., 1st; Somerset, Mass., 1st; Waltham, Mass., 4th; Rowe, Mass., 9th; New Bedford, Mass., 3rd; Wappinger's Falls, N. Y., 5th; Palermo, N. Y., 8th; North Volney, N. Y., 6th; Catawissa, Pa., 2nd; West Charlotte, Vt., 4th; Woodstock, Vt., 4th; New London, Conn., 3rd; *Whippoorwill*: Southington, Conn., 5th; Monticello, Iowa, 8th; Cornish, Me., 6th; Waltham, Mass., 2nd; Clear Creek, Neb., 14th; Catawissa, Pa., 3rd; Woodstock, Vt., 8th; Embarrass, Wis., 1st. *Bobolinks*: Southington, Conn., 17th; Monticello, Iowa, 27th; Cornish, Me., 6th; Somerset, Mass., 4th; Waltham, Mass., 7th; Rowe, Mass., 8th; West Charlotte, Vt., 21st; Strafford, Vt., 15th; Woodstock, Vt., 7th; New London, Conn., 6th. *Catbirds*: Cornish, Me., 1st; Waltham, Mass., 3rd; New Bedford, Mass., 10th; Palermo, N. Y., 22nd; Catawissa, Pa., 5th; West Charlotte, Vt., 21st; Strafford, Vt., 26th. *Hummingbirds*: Wappinger's Falls, N. Y., 22nd; Palermo, N. Y., 7th; Catawissa, Pa., 19th; West Charlotte, Vt., 7th; Embarrass, Wis., 7th. *Martins*: Embarrass, Wis., 7th. *Thrush*: Waltham, Mass., 9th; Northport, Mich., 1st; Wappinger's Falls, N. Y., 12th; Woodstock, Vt., 8th. *Blackbirds*: Northport, Mich., 1st; Clear Creek, Neb., 21st.

MISCELLANEOUS.—*Frogs piping*: Southington, Conn., 5th; Embarrass, Wis., 5th. *Po'ato bug*: Litchfield, Mich., 31st; New London, Conn., 6th; Morgantown, W. Va., 6th. *Rose bugs*: near Johnsontown, Va., 2nd. *Fire-flies*: Southington, Conn., 28th; Logan, Iowa, 1st; Cornish, Me., 24th; North Volney, N. Y., 24th; Kensico, N. Y., 19th; Little Mountain, Ohio, 21st; Green Castle, Pa., 25th; Morgantown, W. Va., 23rd. *Crickets*: Contoocookville, N. H., 16th; Wappingers Falls, N. Y., 18th. *Bees*: Embarrass, Wis., swarmed, 7th. *Mosquitos*: Embarrass, Wis., 28th. *Currant worm*: Bellefontaine, Ohio, 23rd. *Apple worm*: Bellefontaine, Ohio, 31st. *Bats*: Strafford, Vt., 19th. *Grasshoppers*: Dodge City, Kan., 28th.

appearing from the south, swarms not large; Winnemucca, Nev., 24th, myriads appeared in Paradise valley, 20 miles NNE. of station, considerably damaging crops. Brackettville, Tex., 31st, 8 p. m., small black, hard-shelled bugs, resembling flying ant, appeared in such numbers as to make it impossible to stay within doors; at 9 p. m. had to close office in consequence.

Polar Bands.—Maine, 16th, 24th, 25th, 31st; Connecticut, 8th; New Jersey, 7th, 19th, 27th; Virginia, 27th; Indiana, 6th, 19th, 22nd, 24th, 31st; Iowa, 2nd, 3rd, 6th, 13th, 15th, 22nd, 31st; Louisiana, 4th; Nebraska, 5th; Dakota, 27th.

Prairie and Forest Fires.—23rd., Ft. Union, N. M.; 29th., near Wareham, Mass., extensive forest fires; 31st., Bismarck, Dak.

Meteors.—Madison Barracks, N. Y., 27th; Judsonia, Ark., 6th, 9th, 19th; Southington, Conn., 6th; Mayport, Fla., 28th; Anna, Ill., 28th; Como, Ill., 26th; Iowa City, Iowa, 4th; Near Woodstock, Md., 1st, 5th, 6th, 10th, 18th, 21st, 23d, 29th; Rowe, Mass., 2d, 5th, 18th, 23d, 31st; Lebanon, Mo., 28th; Clear Creek, Neb., 25th; Atco, N. J., 26th, 29th; Hector, N. Y., 16th, 8.00 p. m., brilliant meteor moved from W. to E., light very intense, appeared as large as full moon, with train about four times its own diameter; Waterburg, N. Y., 2d, 5th, 23d; Wappingers Falls, N. J., 28th; Fayetteville, N. C., 23d; Cincinnati, Ohio, 27th; Hulmersville, Pa., 10th; Green Castle, Pa., 5th; Aiken, S. C., 25th; Dodge City, Kan., 17th; Davenport, Iowa, 21st, (during bright moonlight); Ft. Whipple, Va., 10th, 8.14 p. m., brilliant meteor in the east alt. 25°, leaving train of greenish hue; Baltimore, Md., 10th, 8.15 p. m., brilliant meteor in the SE., alt. 35°, bright greenish color, exploded like a rocket, leaving train visible several seconds. Tucson, Arizona, 30th, 10:20 a. m., a large meteor fell at base of mountains, ten miles NE of station, leaving train one mile in length; on striking ground a large volume of smoke ascended, which was plainly visible for 10 or 15 seconds.

Zodiacal Light.—Daytona, Fla., 1st to 3rd; 22nd to 24th; 28th to 31st; Monticello, Iowa, 2nd, 4th, 20th, 24th; Clear Creek, Neb., 19th; Atco, N. J., 1st to 3rd; Bellefontaine, Ohio., 22nd; Wytheville, Va., 1st, 29th, 30th.

Earthquakes.—Steamer "Australia" (at San Francisco, May 22nd, from Sydney,) reports heavy earthquakes at Tanna, in the New Hebrides; land rose twenty feet; harbor seriously injured. February 23rd, at Japan; shock lasting one minute; houses rocked. April 12th or 14th, at 8:30 p. m., a severe earthquake occurred in Venezuela, destroying the town of Cua, in the valley of the Tuy, about thirty miles from Caracas, and burying, at least, three hundred persons; the shock was felt at Caracas, and shocks also continued to be felt until May 4th; about the 19th a portion of the town of Ocumare, 20 miles east of Cua, was thrown down; and on the 29th shocks were felt at Laguayra, Caracas, Porto Cabella and Valencia; 28th, U. S. Naval Hospital, Yokohama, Japan, slight shock. May 8th, Sacramento, Cal., 8:25 p. m., shock from N to S, clocks stopped, pictures shook; also reported to have been felt in Colusa and Mendocino Cos." Red Bluff, 8:25 p. m., "vibration N to S, lasting 10 to 15 seconds, clocks stopped, &c." 10th, U. S. Naval Hospital, Yokohama, Japan, at 9:10 p. m., slight shock. 11th, U. S. Naval Hospital, Yokohama, Japan, 7:40 a. m., slight shock.

Sunsets.—The characteristics of the sky as indicative of fair or foul weather for the succeeding twenty-four hours have been obtained at all Signal Service stations. Reports from 104 stations show 3,210 observations to have been taken; of these 52 were reported doubtful; 2,543 cases, or 79.2 per cent., were followed by the expected weather, and 667 were not.

SOLAR PHENOMENA.

Sun spots.—The following observations, made by Mr. D. P. Todd, have been forwarded by Rear Admiral John Rogers, U. S. N., Superintendent of the U. S. Naval Observatory, Washington, D. C.:

May, 1878.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
2nd, 10 a. m...	1	1	0	0	0	0	1	1	Large group of faculae.
12 m...	0	1	0	0	0	0	1	2	
2 p. m...	0	0	0	0	0	0	1	2	
3rd, 10 a. m...	0	0	0	0	0	0	0	0	Faculae and veiled spots. Veiled spots. } Veiled spots and faculae.
4th, 12 m...	0	0	0	0	0	0	0	0	
7th, 4 p. m...	0	0	0	0	0	0	0	0	
5 p. m...	0	0	0	0	0	0	0	0	Veiled spots. Brilliant faculae.
10th, 12 m...	1	2	0	0	0	0	1	2	
2 p. m...	0	0	0	0	0	0	1	2	
21st, 10 a. m...	1	1	0	0	0	0	1	1	
1 p. m...	0	0	0	0	0	0	1	1	
22nd, 12 m...	0	0	0	0	0	0	0	0	
25th, 3 p. m...	2	3	0	0	—	—	2	3	
27th, 11 a. m...	0	10	0	0	0	10	2	13	
28th, 11 a. m...	0	5	0	0	0	0	2	18	
5 p. m...	0	0	0	0	0	0	2	18	
29th, 2 p. m...	0	0	0	0	0	0	2	18	

None visible on the 1st at 11 a. m. and 4 p. m.; 3rd, 1 p. m.; 5th, 3 p. m.; 6th, all day; 8th, 1 p. m.; 11th, 11 a. m.; 13th, 12 m.; 16th, 11 a. m.; 18th, 10 a. m., and 23rd, 11 a. m. The spots visible on the 29th were recorded by the Signal Service Observer at Fort Whipple, Va., as also visible on the 30th, 10 a. m.; and at Portsmouth, N. C., where they continued visible until June 2nd.

Prof. G. Hinrichs, Iowa City, Iowa, reports: none seen 3rd, 4th, 5th, 6th, 8th, 9th, 10th, 12th, 14th, 15th, 19th, 21st, 23rd, 24th; 26th and 27th, one group of two spots; 28th, two groups of six spots. Big spot of 30th very remarkable; no penumbra proper visible, but an apparent depression of photosphere; depression sharply defined, large spot in centre and two smaller on margin. These spots had almost disappeared on June 4th.

Observations of the Transit of Mercury, May 6th, 1878, by Signal Service Assistants and Observers.—The following observations of the Transit of Mercury were made by the observers and officers of the Signal Service, in accordance with special order and instructions: In all cases the observations were made by observing an image of the sun of from two to three inches in diameter, as cast by a field glass of two inches aperture and erecting eye piece upon a sheet of white paper, held by means of a suitable frame work, ten or fifteen inches behind the ocular. The watch-times were reduced to Washington Observatory time by means of corrections afforded by the regular telegraphic noonday signals, sent from the observatory over Western Union lines. The predicted chances of fair observing weather agree well with the actual event; for out of fourteen stations, three were wholly unsuccessful and four partly unsuccessful, owing to cloudiness, whence it is fair to estimate that $\frac{3+\frac{1}{2}+4}{14} = 36$ per cent. of the observations were lost through cloudiness. The corresponding predictions, as given in the fourth column, average 60 per cent. successful, or 40 per cent. lost through cloudiness.

Observations of the Transit of Mercury, May 6, 1878, as reported to the Chief Signal Officer.

STATION.	Longitude.	Latitude.	Predicted change for fair weather.	CONTACTS IN WASHINGTON TIME.				Letter No.	REMARKS.
				0-10.	1.	2.	3.		
Virginia City.....	+35° 0'	45° 20'	5	Obscured.	Obscured.	Obscured.	Obscured.	2779	
Denver.....	28° 1'	39° 45'	3	Obscured.	Obscured.	Obscured.	Obscured.	2633	
Pike's Peak.....	37° 58'	38° 43'	3	Obscured.	Obscured.	Obscured.	Obscured.	2780	
Fort Richardson.....	21° 7'	33° 12'	5						
Sandy Hook.....	— 3° 2'	45° 25'	7	Missed.	H. M. S. 10, 8, 50.	H. M. S. 5, 33, 21.	H. M. S. 5, 35, 44.	2325	Planet half-way on, 10h. 7m. 38s.
Barnegat.....	— 2° 54'	39° 48'	7	Missed.	10, 8, 27.	Obscured.	Obscured.	2688	Planet $\frac{1}{2}$ on at 10h. 5h. 22s.
Atlantic City.....	— 3° 38'	32° 22'	7	Obscured.	Obscured.	5, 32, 45.	5, 35, 35.	2524 2904	
Cape May.....	— 2° 0'	38° 50'	7	Missed.	10, 8, 37.	5, 33, 30.	5, 36, 12.	2781	Planet first seen at 10h. 6m. 48s.
Washington.....	0° 0'	38° 54'	7	Missed.	10, 7, 24.	5, 33, 9.	5, 36, 14.	832 misc.	Planet { well on at 10h. 6m. 0s. on full diam. 10h. 9m. 16s. half-way off, 5h. 34m. 44s.
Fort Whipple.....	+ 0° 1'	38° 50'	7	Missed.	10, 7, 13.	5, 31, 48.	5, 36, 3.	2509 2870	
Cape Henry.....	— 1° 3'	36° 58'	7	Missed.	Missed.	Obscured.	Obscured.	2598	Record unintelligible.
Norfolk.....	— 0° 44'	36° 51'	7	Missed.	Missed.	5, 35, 10.	5, 37, 58.	2565	Unsatisfactorily, through clouds.
Cape Hatteras.....	— 1° 33'	35° 14'	7					3198	Planet not seen.
Cape Lookout.....	— 0° 33'	34° 39'	7	Instruc	tions re	ceived too	late.	2973	
Wilmington.....	+ 1° 7'	34° 11'	7	Missed.	Missed.	5, 29, 32.	5, 36, 22.	2738 2948	[Should not 29m. be 34m. ?]
Smithville.....	+ 0° 58'	33° 51'	7	Obscured.	Obscured.	5, 32*, 15.	6, 34*, 18.	2564	Should probably be 33m. & 36m.
Portsmouth, N. C.*	— 0° 30'	36° 30'	7	*	*	*	*	2737	
Col. College, Col. } orado Springs.. }	+ 27° 46'	38° 50'	3	Missed.	Missed.	5, 32, 56-2.	5, 35, 49-3.	900 misc.	

* Portsmouth observed the contacts at "Watch Time," 10h. 6m. 30s.; 10h. 9m. 40s.; 5h. 38m. 50s.; 5h. 43m. 0s., respectively; but not having received Washington telegraphic time-signals, those times cannot be reduced to the common standard.

NOTES AND EXTRACTS.

The following remarks by Hon. A. H. STEPHENS, of Georgia, as published in the Congressional Record, of June 12th, will be of interest to the observers co-operating with the Signal Service. The subject of the Signal Service being under discussion, Mr. STEPHENS, of Georgia, said:

"I move to amend the pending paragraph by striking out \$325,000 and inserting \$350,000. I do not desire to detain the House at all, but I think this is one of the most important branches of the public service. I learn from General Myer, who is in charge of this service, that if \$350,000 be now appropriated he can extend this service very considerably, far beyond the ratio of the additional amount, compared with the \$300,000, the gross sum appropriated last year. He clearly explained how this could be done. I give an illustration which, I think, clearly presents his idea: It is just as if you had \$300,000 invested in a factory with the steam-power or water-power already supplied sufficient to turn four times the machinery in use, and all that would be necessary to add to its efficiency would be the cost of the bands to set additional necessary machinery in motion. Thus \$25,000 additional to the amount in the bill, he assured me, would enable him so to extend the utility of the system now in operation. The House can readily, I think, understand the illustration. He ran the system with \$300,000 last year, but with \$350,000 he could set on one-fourth more bands to other machinery, if you please. The committee have allowed \$25,000 additional. That is good as far as it goes, but \$25,000 more will double the efficiency of that increase.

"I wish I had time to enlarge on this subject; but I do not wish to detain the committee. I have already said that, in my opinion, this is one of the most important branches of the public service. I would be willing to-day to vote \$500,000 for this service. I am perfectly familiar with the origin of this system of observation. I will be excused, I trust, for saying that the first weather reports ever made were all founded upon Mr. Espy's Philosophy of Storms. His theory was repudiated by American scientists generally. Professor Henry was one of few exceptions. He fared no better with the Royal Society in England. In France he met with more favor. The learned Faraday recommended it to favor. I became acquainted with him (Prof. Espy) here in 1852. I urged him to utilize his theory. He was in this employment at a salary of only \$2,000. He had not the means to command the telegraph. At first we got the editors of the *National Intelligencer* and the *Union*—or may be it was the *Constitution*; at any rate, the other leading paper in the city—to publish, without charge, short reports from distant parts of the country, such as telegraph reports would send. Those reports at first were very meagre. This was in 1854; and they were the first reports of this kind ever published in the world. From these beginnings sprang that grand system which now spans the continent, which is still in its infancy, and from which incalculable advantages to navigation, commerce and agriculture have already been secured, and grander developments are yet in store.

"If we could estimate the value of property saved by these signals during the last year, it would not be less than \$20,000,000. The value of human lives that have been thus saved, who can estimate? Then the advantages to the agricultural interests are incalculable. By an additional appropriation of \$25,000 General Myer, as he told me, will be enabled to enlarge the number of stations very greatly; I forget the exact number, but it largely increases the ratio of the amount of the sum necessary to run the system as it was last year.

"Mr. BANNING. This would give him twenty-five additional men.

"Mr. STEPHENS, of Georgia. And it extends the Signal Service so as greatly to increase its utility. This grand system is but in its infancy. Originating in this country, it has extended over the civilized world; and the extent to which it may yet be carried is, in my opinion, incalculable. Let us give this additional \$25,000. My word for it, the country will be benefited by it more than by the same amount expended in any other way."

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

Brig. Gen. (Bvt. Assg^d.) Chief Signal Officer, U. S. A.

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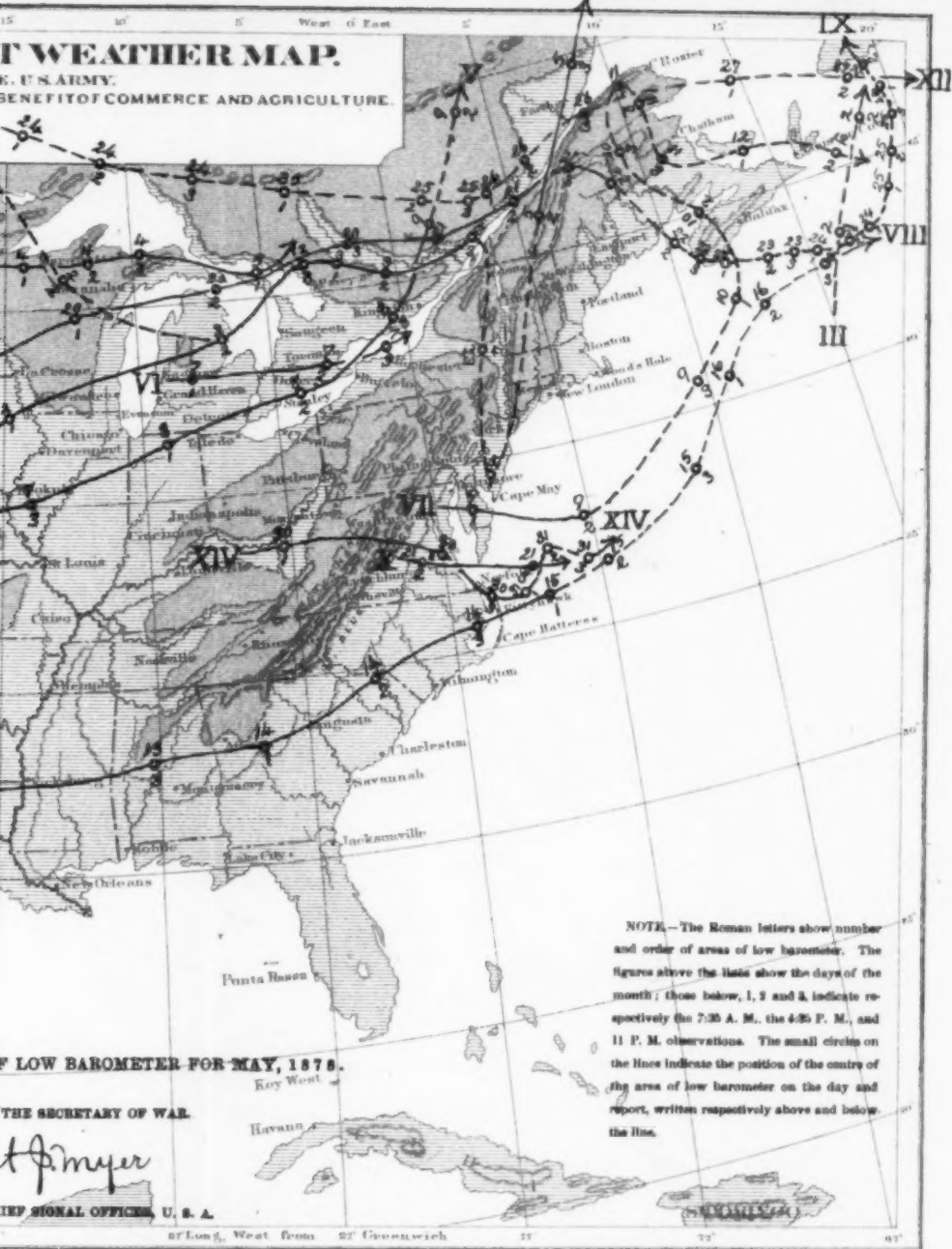
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No. I.



NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3 indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M. observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

LOW BAROMETER FOR MAY, 1878.

THE SECRETARY OF WAR.

H. J. Meyer

REF SIGNAL OFFICER, U. S. A.

St. Louis, West from St. Greenwich

SIGNAL SERVICE, U.S.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT
ISOBARS, ISOTHERMS AND PREVAILING W



AVERAGE TEMPERATURES FOR MAY.			
DISTRICTS	Average of day Signal Service Observations		Comparison of May, 1907 with the average for several years
	For several years	For 1907	
St. Lawrence valley.....	59° 0	54° 8	1° 2 below
New England.....	54. 5	56° 3	1° 7 above
Middle Atlantic States.....	60° 2	63° 6	3° 4 above
South Atlantic States.....	71° 7	73° 4	1° 6 above
Gulf States.....	75° 3	75° 3	0° 0 above
Ohio valley and Tennessee.....	57° 1	62° 6	5° 5 below
Lower Lake region.....	54. 8	55° 2	0° 4 above
Upper Lake region.....	50° 9	50° 0	Normal
Upper Mississippi valley.....	60. 4	58° 0	4° 4 below
Lower Missouri valley.....	66° 4	61° 4	5° 0 below
Missouri.....	54. 3	50° 9	3° 4 below
Rocky Mountains southward.....	46° 7	—	—
Pacific Coast.....	50. 3	59° 4	1° 2 above

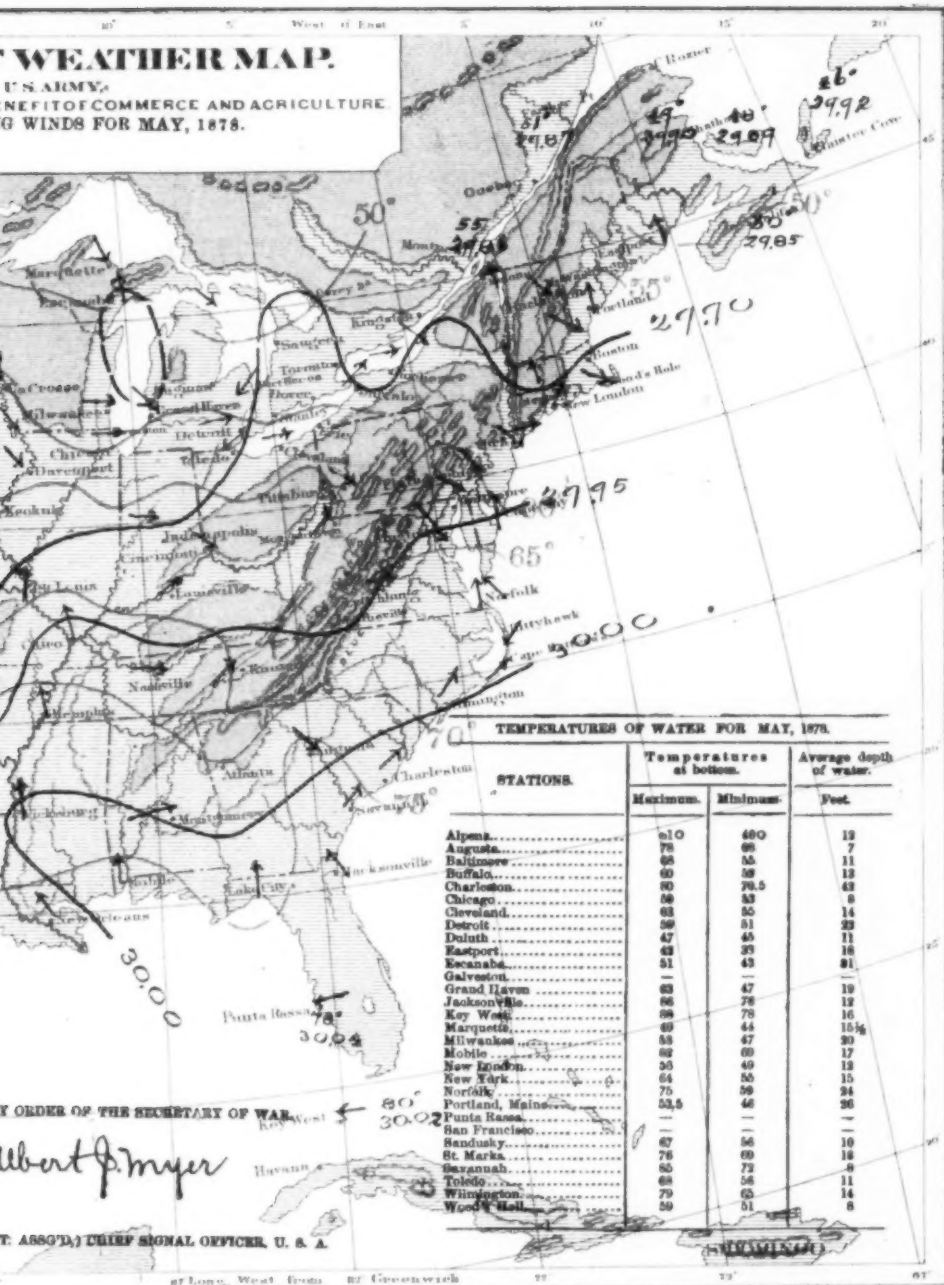
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BRIG. GEN., (NVT: AS

WEATHER MAP.

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G WINDS FOR MAY, 1878.

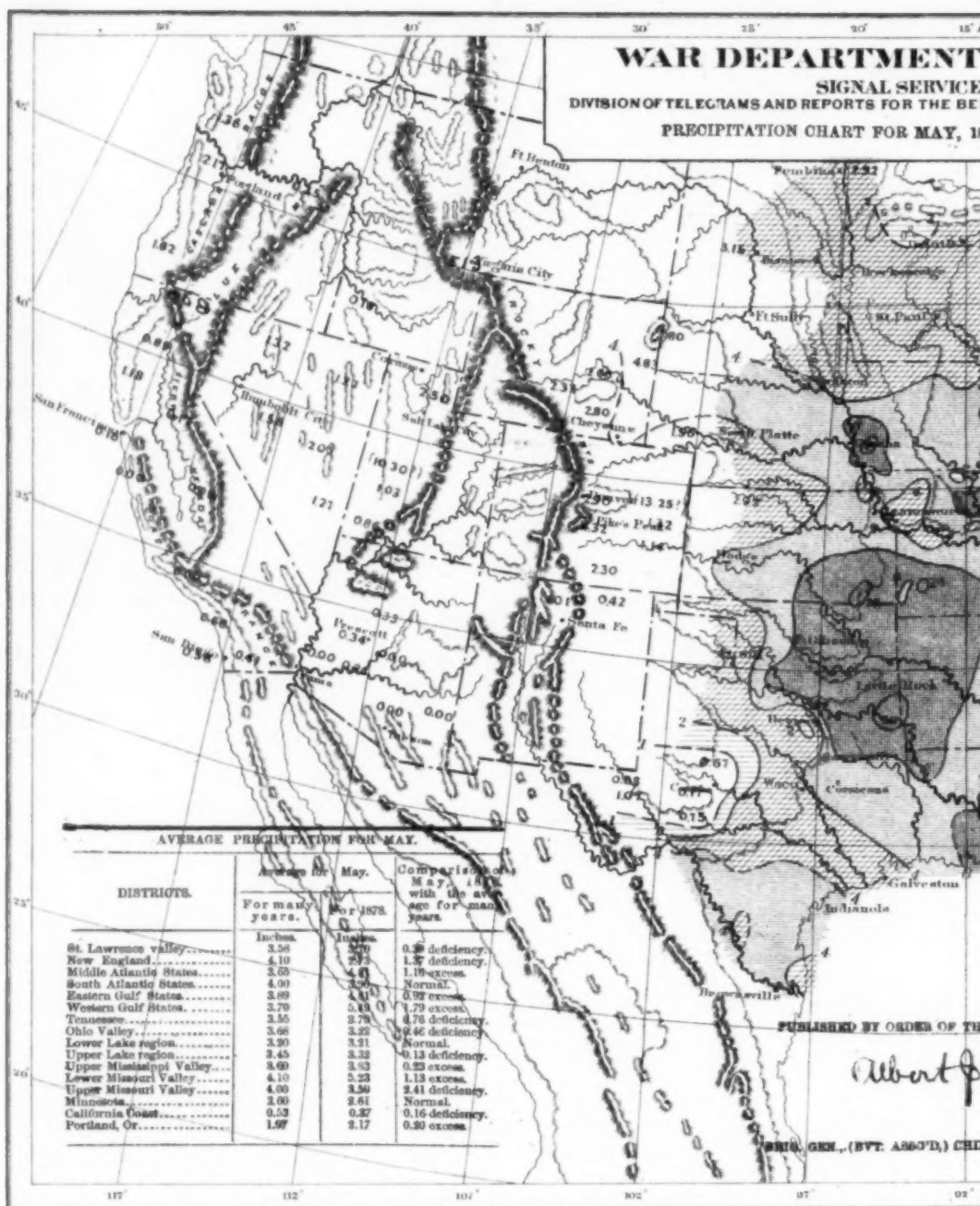


BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

CHIEF SIGNAL OFFICER, U. S. A.

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 PRECIPITATION CHART FOR MAY, 1918



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